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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/938,411	08/23/2001	Wan-Thai Hsu	UOM 0210 PUSP	9988

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EXAMINER	
DOUGHERTY, THOMAS M	
ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 04/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/938,411	HSU ET AL.	
	Examiner	Art Unit	
	Thomas M. Dougherty	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 March 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) *1-7,23 and 24* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-22 and 25-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-7,23 and 24* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 August 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 8, 9, 12, 13,15-19 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) in view of Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators". Nguyen et al. show (fig. 1B) a micromechanical device comprising a substrate (29a); a first micromechanical structure (27a) supported on the substrate (29a) and having a first vertical sidewall (27); a second micromechanical structure (25) supported on the substrate (29a) and having a second vertical sidewall; and a first submicron lateral gap between the first and second vertical sidewalls to increase electromechanical coupling of the first and second micromechanical structures. Note at col. 2, ll. 37-40 that the whole length of the device is on the micron level and therefore it is obvious that the spacing between the components is on the submicron level. The second micromechanical structure (25) comprises an electrode. The first micromechanical structure (27a) is a lateral resonator. The first micromechanical structure (27a) has a third vertical sidewall and wherein the device further comprises a third micromechanical structure (also 25) supported on the substrate (29a) and having a

fourth vertical sidewall and a second submicron lateral gap between the third and fourth vertical sidewalls to increase electromechanical coupling of the first (27a) and third (25) micromechanical structures. As the device is a resonator, the fingers (27a) can flex, thereby constituting a flexural-mode resonator beam. The substrate is a semiconductor substrate. The semiconductor substrate is a silicon substrate.The first submicron lateral gap is a capacitive gap. The second and third micromechanical structures (25) are electrodes. The first and second submicron lateral gaps are capacitive gaps.

Nguyen et al. don't specifically state that the gap is a "sacrifical-film-determined" one. Regarding the argument that the lateral gap is not inherently submicron, this is not persuasive; the applicants do not argue that the gap is not submicron and the description of the invention as being on the micron scale and in fact may have a length and width of 5 microns each. By sight then, the lateral gaps between vertical sidewalls is clearly in the submicron range.

In their article, Hirano et al. note that they employ a sacrificial layer. For example, in the third column, under the heading of paragraph A, they note that in "Figs. 3(c) and 3(d) the silicon dioxide layer is removed". Thus they have described a sacrificial layer. They go on to note immediately after this that the result is that interelectrode gaps are defined. While Hirano et al. show a comb actuator, they don't show a complete device clearly detailing a substrate and components supported on the substrate, though it is within reason to assume that such a substrate is necessary for mounting of his comb actuator.

It would have been obvious to one having ordinary skill in the art to form a device using the teaching method of Hirano et al. such as the device of Nguyen et al. since this is a known method for formation of devices with submicron gaps.

Claims 8-10, 12, 13, 15-20 and 22 are rejected under 35 U.S.C. 103(a) as being anticipated by Adams et al. (US 5,914,553) in view of Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators". Adams et al. show (figs. 9, 10) a micromechanical device comprising a substrate (62); a first micromechanical structure (52) supported on the substrate (112) and having a first vertical sidewall; a second micromechanical structure (82) supported on the substrate (112) and having a second vertical sidewall; and a first submicron lateral gap between the first and second vertical sidewalls to increase electromechanical coupling of the first and second micromechanical structures. Given that the device is on a micron scale, it is obvious that the spacing between the components is on the submicron level. The second micromechanical structure (82) comprises an electrode. The first micromechanical structure (52) is a lateral resonator. The first micromechanical structure (52) has a third vertical sidewall and wherein the device further comprises a third micromechanical structure (80) supported on the substrate (112) and having a fourth vertical sidewall and a second submicron lateral gap between the third and fourth vertical sidewalls to increase electromechanical coupling of the first (52) and third (82) micromechanical structures. As the device is a resonator, its fingers can flex, thereby constituting a flexural-mode resonator beam. The substrate is a semiconductor substrate. The semiconductor substrate is a silicon substrate (see col.

9, ll. 12-15). The first submicron lateral gap is a capacitive gap. The second and third micromechanical structures (80, 82) are electrodes. The first and second submicron lateral gaps are capacitive gaps. The electrodes are metal (122).

In their article, Hirano et al. note that they employ a sacrificial layer. For example, in the third column, under the heading of paragraph A, they note that in "Figs. 3(c) and 3(d) the silicon dioxide layer is removed". Thus they have described a sacrificial layer. They go on to note immediately after this that the result is that interelectrode gaps are defined. While Hirano et al. show a comb actuator, they don't show a complete device clearly detailing a substrate and components supported on the substrate, though it is within reason to assume that such a substrate is necessary for mounting of his comb actuator.

It would have been obvious to one having ordinary skill in the art Adams et al. since this is a known method for formation of devices with submicron gaps.

Claims 10 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap Comb-Drive Microactuators" in view of Ella (US 6,204,737). Given the combined invention of Nguyen et al. and Hirano et al. as described above they don't clearly show metal electrodes. Ella notes use (col. 4, lines 5-10) of metal for electrode material in his microelectromechanical device. His device is not a resonator. It would have bbeen obvious to one having ordinary skill in the art to employ a metal for the material of an electrode, such as is shown by Ella, at the time of the inventions of Nguyen et al. and

Hirano et al. since metal is well known for such use, it is further readily available and the metal chosen can be chosen for specific and known characteristics, e.g. strength, conductivity, bonding ability, etc. Additionally, it would have been obvious to one having ordinary skill in the art to use a metal material for electrodes, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Claims 10, 11, 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators" and further in view of Asano (US 6,316,827). Given the invention of Nguyen et al. and Hirano et al., it is not clear that either uses metal electrodes. Asano notes use (claims 9 and 10) of metal plate for the electrode material in his invention. His invention is not a resonator. It would have been obvious to one having ordinary skill in the art to employ a metal comprising a metal plate for the material of an electrode, such as is taught by Asano, at the time of either invention of Nguyen et al. or Hirano et al. since this material is well known for such use, is readily available, and can be chosen for specific and known characteristics, e.g. strength, conductivity, bonding ability, etc. Additionally, it would have been obvious to one having ordinary skill in the art to use a metal material for electrodes, since it has been held to be within the general skill of a worker in the art to select a known material on the

basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Claims 11 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adams et al. (US 5,914,553) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators" further in view of Asano (US 6,316,827). Given the invention of Adams et al. and Hirano et al. as described above, they fail to note their electrode material as being a metal plate. Asano notes use (claims 9 and 10) of metal plate for electrode material in his invention. His invention is not a resonator. It would have been obvious to one having ordinary skill in the art to employ a metal comprising a metal plate for the material of an electrode, such as is taught by Asano, at the time of the invention of Adams et al. and Hirano et al. since this material is well known for such use, readily available, can be chosen for specific and known characteristics, e.g. strength, conductivity, bonding ability, etc. Additionally, it would have been obvious to one having ordinary skill in the art to use a metal material for electrodes, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators" or of Adams et al. (US 5,914,553) and Hirano et al. article, supplied by the Applicants and

entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators" in view of Capurso et al. (US 6,305,779). Given the invention of Nguyen et al. and Hirano et al. or of Adams et al. and Hirano et al. as described above, they fail to note the material of their lateral resonator. Capurso et al. note use (col. 1, lines 20-30) of polysilicon resonators for the material of resonators in microelectromechanical devices. The device, while comprising resonant components, is an ink jet printing structure. It would have been obvious to one having ordinary skill in the art to employ polysilicon for the material of the resonator, such as is taught by Capurso et al. at the time of the invention of Nguyen et al. and Hirano et al. or Adams et al. and Hirano et al. since this material is well known for such use and readily available. Additionally, it would have been obvious to one having ordinary skill in the art to use a polysilicon material for the resonators, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap Comb-Drive Microactuators" in view of Yazdi et al. (US 6,167,757). Given the invention of Nguyen et al. and Hirano et al. as described above, they fail to note the material of their electrodes. Yazdi et al. note use (col. 7, lines 30-33) of polysilicon for the material of their electrodes in their microelectromechanical devices. The device, while comprising resonant components, is a sensing device. It would have been obvious to one having ordinary skill in the art to

employ polysilicon for the material of the electrodes, such as is taught by Yazdi et al. at the time of the invention of Nguyen et al. and in the invention of Nguyen et al. since this material is well known for such use and readily available. Additionally, it would have been obvious to one having ordinary skill in the art to use a polysilicon material for the electrodes, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators" or Adams et al. (US 5,914,553) and Hirano et al. article, supplied by the Applicants and entitled "Design, Fabrication, and Operation of Submicron Gap comb-Drive Microactuators". Given the invention of Nguyen et al. and Hirano et al. or Adams et al. and Hirano et al. as described above, they fail to note the material of their method of forming the electrode. The method of forming a device is not germane to the issue of patentability of the device itself. *In re Brown* 173 USPQ 685, *in re Fessman* 180 USPQ 324. Therefore this description does not carry any patentable weight.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) or Adams et al. (US 5,914,553) further in view of Asano (US 6,316,827). further in view of Asano (US 6,316,827). Given the invention of either Nguyen et al. or Adams et al. as described above, they fail to note their electrode material as being a metal plate. Asano notes use (claims 9 and 10) of metal plate for

electrode material in his invention. His invention is not a resonator. It would have been obvious to one having ordinary skill in the art to employ a metal comprising a metal plate for the material of an electrode, such as is taught by Asano, at the time of the invention of either Nguyen et al. or Adams et al. since this material is well known for such use, readily available, can be chosen for specific and known characteristics, e.g. strength, conductivity, bonding ability, etc. Additionally, it would have been obvious to one having ordinary skill in the art to use a metal material for electrodes, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

Claims 28-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al. (US 5,491,604) or Adams et al. (US 5,914,553). Given the inventions of either Nguyen et al. or Adams et al. it is not clear that a material characteristic of the first and second micromechanical structures is different, that that difference is grain size, that they are made of the same or different materials, that a same material is poly, that one poly is LPCVD poly and the other poly is epi-poly-Si, and that if different materials, then the different materials are plated metal and poly-Si. It would have been obvious to one having ordinary skill in the art to use a metal material for electrodes, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additional art cited notes use of sacrificial layers in micro devices.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Direct inquiry concerning this action to Examiner Dougherty at (703) 308-1628.

tmd

tmd

April 23, 2003

Thomas M. Dougherty